New Hampshire DOT

FOCUS ON RESEARCH

2003-2 A publication of the Research Office of NHDOT Materials and Research April 2003

Design, construction and maintenance activities often provide the Department with valuable opportunities to evaluate new products, innovative technologies, or applications. These projects are designated as either "Experimental Features" or "Problem Solving" projects.

Examples of these types of projects include:

- Evaluation of a new type of product or material specified during design.
- An experimental installation or process initiated during a construction project.
- Trial-use of a non-qualified product that, if successful, might lead to future inclusion of the product on the Qualified Products List.
- Seeking a solution to a material or design problem through documented experimentation. The "Feature Project" on this page is an example of this type of project.

The potential value of such research activities to the Department is substantial. These evaluations typically cost the Department little in terms of additional funding or manpower, and can provide a valuable supplement to the more formal research activities accomplished through the SPR program.

Experimental Design

To realize the full value of research, the experiment must be carefully designed to assure that the results are meaningful. The Research Office is available to provide guidance in designing a research project and assist in conducting and reporting on the research. A well designed experiment should address the following components:

- **Control Section**

In order to evaluate the performance of any product, material or application, it is necessary to establish a standard or benchmark against which the performance can be compared. Ideally, a control section (e.g. an identical section using conventionally specified materials) should be incorporated into the same bridge or section of roadway. When this is not possible or practical, it is necessary to establish some other means to gauge the results of the experiment. Most importantly, the control must be established up front. It is difficult or

Feature Project

Prolonging Service Life of Weathering Steel Guardrail

It's a beautiful autumn day, driving down the Kanc, the sun is shining, the leaves are at their peak, the guardrail is flapping in the breeze…the what? It may have been like that nearly a decade ago when advanced deterioration of Weathering Steel (Cor-ten) guardrail was observed by highway maintenance forces. Cor-ten has been installed on National Forest land dating back to the early 70's. Because it was thought to have a lower visual impact than the galvanized rail, it was preferred in scenic locations.

Scenes like the one shown here prompted further investigation of the condition of Cor-ten guardrail throughout the State. Mark Morrill (Maint. Dist. 3), Center Sanders (Maint. Dist. 2), Bruce Knox (Construction), Mike Fudala (Hwy. Des.), Glenn Roberts, Alan Rawson and Chris Hawkins (M&R) comprised the committee that performed the condition survey. They found that after 10-15 years in service, 50% of lap connections and 25% of the rail at mid-span were inadequate.

Furthermore, after 15-20 years in service, 71% of lap connections were failing while the mid-span rate of failure remained at 25%. Any rail with a 10% or greater section loss from the original nominal thickness of 0.109" was considered inadequate. Galvanized rail of the same age had no section loss.

Of 40 States responding, 20 do not use Cor-ten rail; those that do, limit use to scenic areas. Michigan and California stopped using it due to premature deterioration. The committee issued a report in 1997 recommending replacement of Cor-ten with galvanized rail at the end of its functional life. Prior to implementing these recommendations, the Department also investigated ways to make the Cor-ten last longer. Guardrail sections were treated with various corrosion inhibiting and water proofing products and bolted together to simulate lab connections. The samples were conditioned for 5000 hours in a 5% salt fog. Following conditioning, the samples were evaluated for overall condition. The most effective treatment was a piece of pure zinc foil shaped to fit between sections. This virtually stopped corrosion from occurring in between the sections. In 2002, language was added to the Standard Specifications requiring the use of zinc inserts at all lap locations. However, the use of zinc can be expected to add 25% or more to the cost of guardrail installations. Because of safety and financial considerations, the Department, with backing from the US Forest Service, will be implementing the committee's 1997 recommendations, pending further developments in weathering steel technology.

To learn more about this research, contact the NHDOT Research Office at (603) 271-3151.

impossible to effectively assess an application after it is built if proper design and control techniques were not incorporated.

- **Control of Variability**

Variability that is not accounted for is perhaps the most destructive component of any research activity. Comparing two types of pavement surface mix, for example, is meaningless if the underlying pavement layers and/or base materials also vary. Likewise, attributing the superior performance of a bridge deck to a chemical admixture may be inappropriate if other mix design parameters or placement techniques varied as well. Without proper control, it is simply impossible to accurately determine which parameter contributed most to the change in performance.

- **Monitoring and Documentation**

The full results of many product or process evaluations may not be known until the performance has been monitored over time. Research Office staff routinely track the performance of a number of "Experimental Features" and compare the performance of these installations with the appropriate control. Results and observations are carefully documented.

- **Reporting**

To allow full utilization of the results of our research/evaluation efforts, the results must be made available to those who can make best use of it. The Research Office is available to help with reporting of results and distribution of the reports. In addition to making reports and results available to the Department's decision makers, they are also submitted to appropriate information services including TRIS, RIP, APEL and others.

Literature Search

Often the answers to our research questions can be found in research that already exists. A comprehensive literature search can avoid duplicating the efforts of others. A variety of online, national databases provide information on completed and ongoing research. The Research Office is available to seek out information using the following resources:

- **TRIS –** The "Transportation Research Information Service" is the largest and most comprehensive source of information on published transportation research on the Web. The TRIS database can be found at http://ntl.bts.gov/tris

- **RIP –** The "Research In Progress" database contains records of current or recently completed transportation research projects. The RIP database contains research projects funded by Federal and State Departments of Transportation as well as University research and records from the Canadian Surface Transportation Research Database. This database can be found at http://rip.trb.org/

- **APEL –** The "AASHTO Product Evaluation List" is a database providing access to findings from the evaluation and testing of new and/or proprietary engineered transportation products. This site also provides contact information for manufacturers and the State transportation agencies performing the evaluations. This database can be found at http://www.transportation.org/programs/apel/site.nsf/homepage/Overview?OpenDocument

- **NTPEP –** The "National Transportation Product Evaluation Program" was established in early 1994 as an engineering technical service program to pool the professional and physical resources of AASHTO's member departments to test transportation materials of common interest. NTPEP provides test results for a variety of Highway Safety Products and Construction Materials. This site can be found at http://www.ntpep.org/programs/ntpep/site.nsf/AllPages/Overview

- **HITEC** – The Highway Innovative Technology Evaluation Center is a nationally recognized, first-stop service center and clearinghouse for implementing highway innovation. HITEC conducts impartial performance evaluations for market-ready products where standards or specifications do not exist. HITEC accepts both "high-tech" and "low-tech" products and/or technologies that are intended for use in any aspect of the highway community including design, construction, operation, or maintenance. This site can be found at http://www.cerf.org/hitec/

Research Suggestion Form

If you have an idea for a research project or product/process evaluation, please submit it to the Research Office on the form available at http://www.t2.unh.edu/nhdotresearch/research/ProjectSuggestForm.PDF or contact the Research Office at 271-3151.

For more info

Visit the NHDOT Research Website at http://www.t2.unh.edu/nhdotresearch/index.html